Benjamin G. Pierce

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RESEARCH INTERESTS

Computer Vision **Machine Learning** **Photovoltaics** **Distributed Computing**

EDUCATION

Case Western Reserve University
Aug 2017 – Expected May 2021/2022
B.S. Computer Science/ M.S. Computer Science
Cleveland, OH

- GPA: 3.6
- Coursework: Algorithms, Databases, Data Structures, Intro. Artificial Intelligence, Software Engineering
- Dual Degree Program- B.S./M.S. completed simultaneously

EXPERIENCE

Sandia National Laboratories
May 2020 – Present
R&D Intern- Photovoltaic Systems Evaluation Laboratory
Albuquerque, NM

Improving Single Axis Tracking Algorithms Using Sky Imagery and Machine Learning

- Supervisors: Joshua Stein, Jennifer Braid, Daniel Riley
- Objective: Improve energy yield of single axis trackers via a new, machine learning based control algorithm that takes sky images as input.
- Cleaned data set of over 100K images (months of 1 minute interval data) in Sandia HPC enviroment
- Created novel multi-input convolutional neural network to find angle of maximal irradiance.
- Model gives a mean absolute percent error of under 5% on most days

Solar Durability and Lifetime Extension Center
Aug 2018 – Present
Research Assistant
Cleveland, OH

Video/Image Processing on Crystal formation on Ni-Al alloys

- Faculty: Roger French, Jennifer Carter, Masayoshi Adachi, Hiroyuki Fukuyama
  - Collaborated on a joint project with researchers from Tohoku University, Japan
- Objective: Analyze video of rotating, molten droplet of NiAl with the aim of determining a rate of crystallization
- Analyzed over 100,000 images across 4 samples at varying temperature and composition
- Confirmed theoretical Avrami crystallization behavior with data-driven model

Feature Extraction and Unsupervised Learning on Electroluminescence Images

- Faculty: Roger French, Jennifer Braid
- Objective: Use unsupervised learning to classify types of degradation of solar modules through electroluminescence images in a dataset of 11,000 images
- Experiments: Took electroluminescence measurements on mini-modules and adjusted data processing step to enable further analysis
- Extracted local features (blots of corrosion, darkening) using algorithms such as SIFT and KAZE

- Found module-level features with Haralick/GLCM features and specialized extraction methods
- Modeled local features using bag-of-words model, and applied hierarchical clustering to identify classes

PUBLICATIONS

- **Benjamin G Pierce**, Ahmad Maroof Karimi, Jiqi Liu, Roger H French, and Jennifer L Braid. "Identifying Degradation Modes of Photovoltaic Modules Using Unsupervised Machine Learning on Electroluminescence Images" *IEEE Photovoltaics Specialists Conference 2020*
- Carolina M. Whitaker, **Benjamin G Pierce**, Ahmad Maroof Karimi, Roger H French, and Jennifer L Braid. "PV Cell Cracks and Impacts on Electrical Performance" *IEEE Photovoltaics Specialists Conference 2020*
- Ahmad Maroof Karimi, Justin S Fada, Nicholas A Parrilla, **Benjamin G Pierce**, Mehmet Koyutürk, Roger H French, and Jennifer L Braid. "Generalized and Mechanistic PV Module Performance Prediction from Computer Vision and Machine Learning on Electroluminescence Images." *IEEE Journal of Photovoltaics*
- **Benjamin Pierce**, Ahmad Karimi, Laura Wilson, Andrew Loach, Sonoko Hamaya, Justin Fada, Masayosi Adachi, Hiroyuki Fukuyama, Roger H. French, and J.L.W. Carter. 2019. "Image Processing on Crystallization Growth of Rotating and Levitated Alloys." Poster, 2019 CWRU/Tohoku Symposium on Data Science in Life Sciences and Engineering, August 5.

PROJECTS

- Web-scraping online sports databases to track and predict player growth from the NCAA to the NBA, published on data.world
- Web marketplace with Flask frontend using MySQL backend
- Peer-to-peer local area network IDE for Python
- Raspberry Pi based handheld license plate identification device

AWARDS

DOE Science Undergraduate Laboratory Internships (SULI) — Lawrence Berkeley National Lab
Offered SULI funding for Summer 2020, declined for Sandia — May 2020

SURES Scholar — CWRU SOURCE
Awarded grant funding for summer research — May 2019

Choose Ohio First Awardee- Data Science Cohort — State of Ohio
Recognized for STEM skills and awarded scholarship for education in data science — Aug 2017-

TECHNOLOGIES

Programming Languages	Python, R, Java, C, bash
Libraries	Tensorflow/Keras, NumPy, sklearn, scipy, openCV, pandas
Databases	Hadoop2/Hbase, MySQL
Other	High-performance computing, LaTeX, Jira, Kanban, Git, vim

ACTIVITIES

Association for Computing Machinery	Student Member, 2019
Institute of Electrical and Electronics Engineers	Student Member, 2020
Study Abroad	Cape Town, South Africa, Summer 2018